International Journal of Gender, Science and Technology
http://genderandset.open.ac.uk

Guest Editorial Special Issue
Girls' and women's participation in STEM: Past lessons and possible futures

Guest Editors: Penelope Watson[1], Audrey Cooke[2], and John Thornby[3]
The University of Auckland, New Zealand[1],
Curtin University, Australia[2], University of Warwick, UK[3]

Although the presence of women and girls in many Science, Technology, Engineering, and Mathematics (STEM) fields has increased in recent decades, women remain underrepresented in STEM in comparison to men (Watt, 2010). Structures and processes that compromise women and girls' entry to and advancement in STEM fields (e.g., cultural messages, see Halpern, Benbow, Geary, Gur, Hyde & Gernsbacher, 2007) appear to persist despite historical evidence of female ability and competence in STEM (OECD, 2015). The current Special Issue 'Girls' and women's participation in STEM: Past lessons and possible futures', foregrounds the need for vigilance in ensuring equitable STEM opportunities for women and girls, in the light of historical events. However, the Special Issue also reports evidence and approaches that offer forward momentum in addressing inequitable opportunity and promoting futures for women and girls, in a diversity of STEM fields.

Presentations delivered at the 3rd Gender and STEM Network Conference (held 21-23 July, 2016, at The University of Newcastle, Newcastle, UK) form the basis for the Special Issue. Two of the conference's keynote speakers (Sue Rosser and Patricia Fara) supply focal articles informing past lessons and current concerns regarding the status quo for women in STEM. Further papers highlight 2016 conference themes such as, positive action measures embracing STEM initiatives, and the impact of individual, family, teacher and peer processes on STEM trajectories. Helen M. G. Watt, Noortje Jansen, and Jenefer Husman preface the Special Issue with a background outline of the Gender and STEM network, and introduce the upcoming 4th Gender and STEM Network Conference, to be held in July-August 2018 at The University of Oregon, Eugene, USA.

Patricia Fara's perspective piece A Lab of One's Own: Science and Suffrage in the First World War encapsulates the experiences of women scientists in Britain in the early years of the twentieth century. In three extracts from her 2018 book of the same name, Fara describes women's struggle to be taken seriously as mathematicians, doctors, and scientists despite making key contributions in these roles. Fara reminds us that subtle and often occluded prejudices persist as barriers to female participation in STEM fields.

In Breaking into the Lab: Engineering Progress for Women in Science and Technology Sue V. Rosser presents a case study of women in STEM fields and the issues they faced, finding both positive moves yet the persistence of other issues such as gender discrimination over more than a decade. The analysis explored the percentage of women completing bachelor, masters, and doctoral degrees in STEM disciplines; women in assistant, associate, and full professorships in STEM disciplines at academic institutions; and issues facing women in STEM fields.

Janine Neuhaus and Andreas Borowski's research paper specifically explores Grade 9 and 10 German female students' interest in computer science (traditionally a masculine domain). In their paper 'Self-to-Prototype Similarity as a Mediator Between Gender and Students' Interest in Learning to Code' the authors explain how girls' interest in learning to code increased when communal rather than agentic goals (associated with femininity and masculinity, respectively) were linked to computer coding courses. The findings of the paper inform future interventions to encourage girls' entry to computer coding.

Interest and confidence have posed barriers to girls' involvement in technology careers in many European contexts. In a case study of German adolescent females, Pia Spangenberger, Felix Kapp, Linda Kruse, Martin Hartmann, and Susanne Narciss ask Can a Serious Game Attract Girls to Technology Professions? The authors report on the design process and success of a serious computer game aimed at increasing girls' motivation and interest in technical tasks. Importantly the authors investigated how social relevance influenced the young women's decisions.

Women's futures in computer science are further explored by Silvia Förtsch, Anja Gärtig-Daugs, Sandra Buchholz, and Ute Schmid in their research article '"Keep IT Going, Girl!" An Empirical Analysis of Gender Differences and Inequalities in Computer Sciences.' The authors explore differences in academic achievement between male and female computer science graduates in Germany, and the consequent impact on their respective self-efficacy beliefs, career ambitions and opportunities.

Investigating forces that influence STEM (and non-STEM) career choice Meeta Banerjee, Katerina Schenke, Arena Lam, and Jacquelynne S. Eccles investigate The Roles of Teachers, Classroom Experiences, and Finding Balance: A Qualitative Perspective on the Experiences and Expectations of Females Within STEM and Non-STEM Careers. Within their research paper the authors illuminate the role of teachers in influencing students' propensity to choose STEM careers (or not), by promoting (or inhibiting) efficacy, interest and value in mathematics.

The impact of parental influence on STEM-career choice is the focus of the paper Parental Influence(s) on Who Seeks a Career in STEM: The Primacy of Gender by Adam Lloyd, Jenny Gore, Kathryn Holmes, Max Smith, Leanne Fray. Data from a longitudinal study involving children and their parents was used. The paper focused on students who had indicated they were interested in a career in STEM that would typically require university qualifications and the educational expectations of their parents.

Two final articles explore the intersectionality between ethnicity, gender and context in influencing engagement in STEM. The first is a case study reported by David M. Sparks, Are you African or African-American? Exploring the Identity Experiences of United States Female STEM Students Born in Africa. The paper used the students' own words to explore how they believe their African heritage and their views of themselves within the African-American community in the US contributed to their development as students in STEM education.

Finally, Munaza Nausheen and Paul Richardson's perspective piece Gender and Disciplinary Differences in Future Plans of Postgraduate Students in Pakistan explores the career intentions of postgraduates sampled from five different departments at a university in Pakistan. In particular, the authors discuss the role that cultural context can play in career-planning and the interplay between higher education and individuals' willingness to challenge cultural norms.

The Special Issue presents research situated in a range of international contexts, a variety of educational sectors, and within diverse STEM-related disciplines. Complementary perspectives informing the access of women and girls to pathways toward and promotion within STEM careers, shed light on past lessons and future possibilities. Importantly, challenges for future research, practice, and policy further reflect the theme of the 2016 conference 'Promoting girls' and women's participation in STEM advancement and innovation: Connecting research with global policy and practice'.

ACKNOWLEDGEMENTS
The editors gratefully acknowledge the copyediting services of Nina and Sophie of Bresser-Chapple Copy, Proofing and Translation, and funding facilitating their engagement received from The University of Auckland.

REFERENCES

Halpern, D. F., Benbow, C. P., Geary, P.C., Gur, R.L., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, *8*, 1–51.

OECD. (2015). *The ABC of gender equality in education: Aptitude, behaviour, Confidence* PISA, OECD Publishing: Paris, France. doi:10.1787/9789264229945-en

Watt, H. M. G. (2010). Gender and occupational choice. In J. C. Chrisler & D.R.McCreary (Eds.), *Handbook of gender research in psychology*. NewYork, NY: Springer.